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WILDLIFE OF THE LAKE TAHOE REGION

A Guide for Planning

Prepared for
Tahoe Regional Planning Agency
and
Forest Service, U. S. Department of Agriculture

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Establishment of the Tahoe Regional Planning Agency was consented to by the Congress through enactment of Public Law 91-148. On March 19, 1970, the governors of Nevada and California signed the proclamation that proclaimed creation of the Tahoe Regional Planning Agency. Since the authorized staff of the Agency was small, it enlisted help from several committees composed of technical specialists and other citizens concerned with resource conservation and orderly development of the Tahoe environmental resources.

The planning effort has been aided greatly by generous cooperation from numerous federal, state, county, and municipal agencies and from several colleges and interested private individuals. Cooperating agencies include:

Federal:

Department of Agriculture: Forest Service; Soil Conservation Service

Department of Commerce: Environmental Science Services Administration

Department of Defense: Army Corps of Engineers

Department of Interior: The Bureaus of Mines, Outdoor Recreation, Reclamation, Sport Fisheries and Wildlife; Federal Water Quality Administration; and the Geological Survey

Department of Transportation: Coast Guard; Federal Highway Administration; Federal Aviation Administration

State:

California: Resources Agency of California; the Departments of Public Health and Water Resources; the Divisions of Highways, Mines and Geology, and Lands; State Lands Commission

Nevada: Nevada Department of Conservation and Natural Resources; Bureau of Environmental Health; Division of Mines; Highway Department

County and Municipal:

Carson City, Douglas, and Washoe Counties, Nevada; El Dorado and Placer Counties and City of South Lake Tahoe, California

Schools:

Foresta Institute; Sacramento State College; Tahoe College; University of California at Berkeley and Davis; University of Nevada; Desert Research Institute

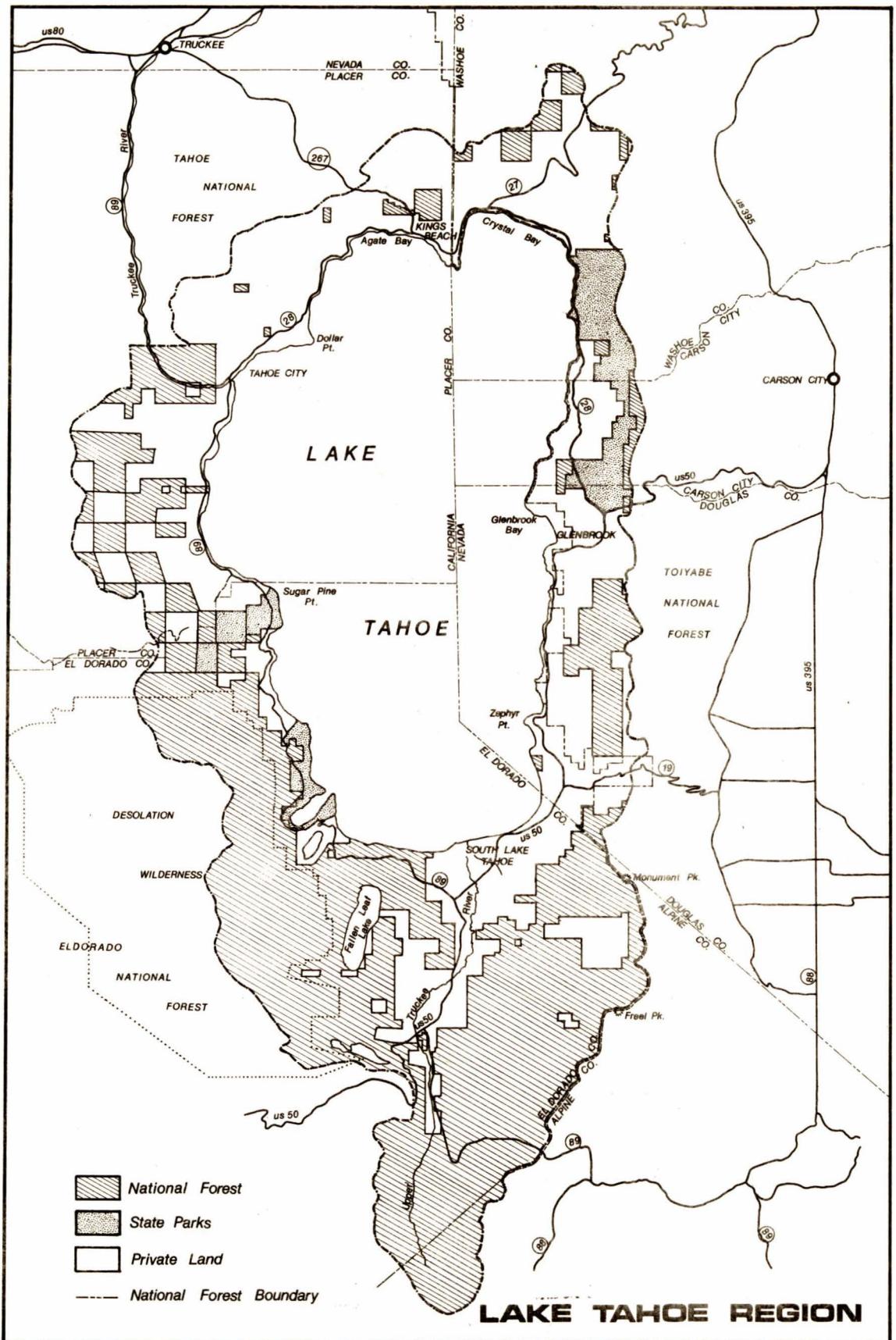
Any publication that compiles and presents information from so large and disparate a group of contributors as this one does is susceptible to error, inconsistency, and omission. Sustained effort has been made to avoid these flaws; but if it has failed occasionally, the reader's forbearance is humbly solicited.

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INTRODUCTION

General Features of the Lake Tahoe Planning Area

Lake Tahoe and the mountainous timber-covered basin immediately surrounding it provide one of the most beautiful environments in the Sierra Nevada and in the nation. The Lake itself, an irregular oval about 22 miles long by 12 miles wide, covers 191 square miles; it occupies a deep depression between crests of the Sierra Nevada and Carson ranges. Since its surface is 6,225 feet above mean sea level, Lake Tahoe is one of the largest high-altitude lakes in the world. The clarity and purity of its water are outstanding. In fact, protection of quality of the water in Lake Tahoe is a primary objective for effective control of the region's environment.

The spectacular scenery of the Lake Tahoe Region results from unique geological conditions that prevailed when the Lake was formed. The basement rock is predominantly granite related to the rocks found throughout the Sierra Nevada. On the other hand, the geologic structure--the faulting that produced the Lake basin itself--is related to the Basin Ranges that extend eastward from the Sierra to the Wasatch Range in Utah. The Lake was formed by a natural dam--a great pile of andesitic mudflow breccia--across the north outlet.

Lake Tahoe is on the eastern boundary of that part of the Sierra Nevada that was extensively glaciated during the Pleistocene epoch. Huge valley glaciers moved down canyons along the western side of the Lake, scouring away loose rock and building up great piles of morainal debris. Along the eastern side, glaciers developed only on the shaded side of the highest peaks; so most of this area was not glaciated. This accounts for the subdued rolling topography typical of the Carson Range, as contrasted to the rugged Sierran crest on the west side of the basin.

Climate of the region is strongly influenced by topography. Marine air from the Pacific Ocean, 150 miles to the west, drops its moisture (mostly as snow) as it rises over the crest of the Sierra. Average annual precipitation ranges from more than 50 inches on the western side of the region to about 25 inches along much of the eastern shoreline. The Weather Bureau at Tahoe City, on the west side, reports long-term average snowfall of 213 inches. The fairly long summers are comparatively cool; mean maximum temperature at Tahoe City in July over a 50-year period was 78° F. Winters are cold but seldom severe; mean daily minimum temperature for January over the same period was 17° F. The high elevation and cool temperatures result in a short growing season--an average of only 70 to 120 frost-free days per year at various points near the Lake.

Vegetation includes desert, montane, and alpine species typical of the eastern slopes of the Sierra. Pine and fir forests were heavily logged between 1860 and 1900 when demand for lumber and props for the Nevada silver mines was high. Even so, today the region has good stands of conifers between the Lake level and 9,000 feet, plus considerable areas covered by chaparral and other brush. On fairly level open areas that have a few inches of soil, grasses and other herbage flourish during the short growing season.

Nearly 300 species of animals and birds inhabit the Lake Tahoe Region. Deer, bear, mountain lion, coyote, rabbit, raccoon, and several rodents are common. Land birds and waterfowl are present in small numbers consistent with available habitat. Heavy commercial fishing in the Lake around 1900 depleted native populations of cutthroat trout and whitefish, but kokanee salmon and several species of fish stocked from state hatcheries provide good recreational fishing today. Numerous tributary streams also provide sport fishing.

Soils are generally shallow and highly erodible—easily disturbed and slow to stabilize—but the soil is fairly deep in some bottom lands and glacial debris areas. The varied climate and highly erodible soils combine to make the Lake Tahoe region a fragile environment. Hence the ecological balance is easily upset. Whenever vegetation is removed, it is not soon replaced. Erosion by wind and water is a constant hazard; it damages pristine features of the Lake, including the spawning areas of native fish.

Changing Environment

Before the white man invaded this area about the middle of the 1800's, the somewhat nomadic Washoe Indian tribe inhabited it. Their name for the lake, "Tahoe," has been variously translated as "big water," "high water," or "water in a high place." The first recorded white visitors were John Fremont's exploring party (1844); they were soon followed by the Forty-niners and other western migrants and adventurers.

During most of the following 100 years, Lake Tahoe was the summer recreation area for wealthy Californians, mostly from San Francisco and the Sacramento Valley. The few summer resorts, scattered stores, service stations, and restaurants hardly marred the natural beauty of the region.

Soon after World War II all this began to change. With increased general affluence, steadily and rapidly increasing numbers of vacationers began to visit the area; their visits gradually extended the "season" from summer to the full year. Establishment of year-round casinos at Stateline in 1955 and the phenomenal growth of winter sports added to the influx of both visitors and residents. By unofficial count in 1965, the region had nearly 29,000 yearlong residents—more than double the 1960 federal census figure. Present projections anticipate more than 50,000 residents by 1980 and an added summer population topping 250,000. California is the most populous state in the nation, and Nevada boasts of being the fastest growing state. Most of the growth of population in both states is in an area within an hour's drive of Lake Tahoe.

These projected increases in resident and transient populations will inevitably multiply and intensify the environmental problems that already are plaguing the area. Already the region's ability to produce wildlife in numbers comparable to those produced earlier has been reduced sharply by urbanization of much of the Lake shore area. Whatever might be accomplished in improving wildlife habitat can be completely nullified by uncontrolled urban development, additional construction of freeways, and the unchecked influx of transient visitors. Hence the crucial need for planning orderly development that can be sustained by the natural capacities of the region.

Administrative and Governmental Responsibility

The Planning Area established by the Bi-State Planning Compact between the States of California and Nevada is a basin covering 332,160 acres plus 3,340 acres near the Lake outlet in the Lower Truckee River drainage. This includes the 122,628 acres of lake surface. Governmental jurisdiction over land in the Lake Tahoe Planning Area is complex. The Area is divided between California (Placer, El Dorado, and Alpine Counties) and Nevada (Washoe and Douglas Counties and Carson City). This division of governmental responsibility makes it difficult to coordinate the administration of government in the Area in the interest of protecting the environment.

Nearly half (48.7 percent) of the land area is federally owned—chiefly in three National Forests totaling 103,872 acres. An additional 4.5 percent is state-owned, nearly all in State Parks. Thus about 53 percent of the land in the Planning Area is publicly owned.

Of nearly 75 miles of lake shoreline, about 23 percent is publicly owned. This is chiefly 8 miles belonging to the State of California, 3.5 miles (chiefly in State parks) owned by the State of Nevada, and 5.5 miles in National Forests.

Tahoe Regional Planning Agency (TRPA)

The Tahoe Regional Planning Agency began work as soon as the governors of California and Nevada signed the proclamation creating the Bi-State Planning Agency. Public Law 91-148 had enumerated the dangers of deterioration of the natural environment at Tahoe and of the increasing demands on various natural resources and features of the Region; also, it emphatically stated the need to maintain equilibrium between the Region's natural endowment and limitations on one hand and the environment that man is creating. It recognized need for establishing "an area-wide planning agency with powers to adopt and enforce a regional plan of resource conservation and orderly development, to exercise effective environmental controls, and to perform other essential functions...."

TRPA was ordered to develop and adopt, within 18 months of its formation (i.e. by September 1971), a plan for regional development that would include separate plans for land use, transportation, conservation, recreational development, and public services and facilities, to name a few. The Agency was further directed to consider and to seek to harmonize the needs of the whole Region with the plans of local governmental units and the existing land use plans of State and Federal agencies.

Since nearly half of the land area in the Lake Tahoe Region is in National Forests, the Forest Service has major responsibility for improving environmental features here. In 1970 it established the Lake Tahoe Basin Planning Team to work with TRPA. Although the Agency and Team have separate organizations and responsibilities, they have cooperated closely to achieve a common goal.

This publication incorporates results of comprehensive studies of the wildlife resource in the Lake Tahoe Region made by a technical committee of specialists (p. iii). Information herein is intended chiefly to guide regional planning.

MAMMALS

The mammals living in the Lake Tahoe Region can be grouped into three categories: **large mammals** (deer, bear, and mountain lion), 5 species; **small mammals** (e.g., squirrels, mice, and rabbits), 52 species; and **furbearers** (medium-sized mammals such as raccoon, fox, and weasel), 15 species.

Large Mammals

Three species of deer, the black bear, and the mountain lion make up the category of large mammals. These five species live in one of Nature's most mutually beneficial relationships. The mountain lion depends on the deer as its most important source of food. The deer, in turn, depends upon the mountain lion to remove the weak and sick animals from the deer herd and thereby maintain the population within the limits of the supply of available food. The bear does not depend on deer for his survival, but he kills newborn fawns, sick and weak animals, and cleans up any deer carrion he finds.

Except in areas of the Upper Truckee River basin and the Desolation Wilderness, the prospects for populations of these large animals to continue as an integral part of the ecosystem here are not bright. The mule deer, black-tailed deer, and California mule deer are in moderate numbers, but their populations must be regarded as unstable. Since so few black bears and mountain lion still live in this region, they must be classed as rare. The bear and lion both have low capability for withstanding disturbances to their natural habitats (table 1), but deer can tolerate some such disturbance.

Table 1. -- Range and habitat of large mammals in the Lake Tahoe Region

Species	Range	Habitat type ^{1/}
Mule deer (<i>Odocoileus hemionus hemionus</i>)	N, S & E Basin (summer)	2, 4, 6, 7, 9, 17
Black-tailed deer (<i>Odocoileus hemionus columbianus</i>)	West Basin (summer)	2, 4, 6, 7, 9, 11
California mule deer (<i>Odocoileus hemionus californicus</i>)	West Basin (summer)	2, 4, 6, 7, 9, 17
Black bear (<i>Ursus americanus</i>)	West Basin	2, 6, 7, 9, 17, 18
Mountain lion (<i>Felis concolor</i>)	Basin	2, 4, 6, 7, 9, 17

^{1/} Numerals refer to serial numbers of habitat types listed on pp. 14 - 15.

Small Mammals

All but three of the 52 species of small mammals in the Lake Tahoe Region are found throughout the area. The three exceptions are the dwarf shrew, found around streams; the broad-bearded mole, found only in meadows; and the black-tailed jackrabbit, found only at lower elevations. All but 4 of the 52 species (white-tailed jackrabbit, northern flying squirrel, spotted bat, and the pika) can tolerate some disturbance to their habitat. The populations of species of small mammals in the Region vary from few and endangered to abundant (table 2), but populations of individual species have remained fairly stable.

The value of small mammals in an ecological system often depends on the point of view. Children regard them as attractive pets; homeowners and campers may regard them as nuisances; public health officers may fear that they will carry contagious diseases; and ecologists may consider them a key link in Nature's life cycle.

A few of the more common small mammals are ground and tree squirrels, rabbits, hares, chipmunks, bats, and shrews. These animals can damage gardens, flower beds, and buildings; carry diseases, such as rabies and black plague; and are readily usable for recreation as small game species as well as subjects for scientific study.

The insectivores (e.g. the bats and shrews) are beneficial to man because they eat many kinds of troublesome insects. But bats have also been known to carry rabies. In the Lake Tahoe Region, however, only a few instances of a bat's transmitting rabies have been recorded. The ground squirrel and chipmunk group have been hosts to the flea that carries black plague and they eat large numbers of tree seeds. The Tahoe Region has never had any serious outbreak of plague, but one could come if these animals' numbers should ever increase significantly.

Some small mammals are destructive pests in forests and meadows. Porcupines and rabbits destroy many small trees. The burrowing animals (e.g., gophers and ground squirrels) often damage meadows or other grassland areas. Some small mammals may be detrimental to man's activities, but they can be important entities to the Tahoe Basin biome. Small mammals form important food chains that are necessary to survival of the raptors (hawks and owls), most of the medium-sized mammals (furbearers), and the mountain lion.

Most small mammals are territorial; i.e., they live in a limited local area. For this reason, those that live in only one or two types of habitat are more vulnerable to disturbances created by man than those that can survive in several different types of habitat. In the Lake Tahoe Region, bats, beaver, jackrabbits, two species of mice and shrews, and the Western gray squirrel are the only common species that have narrowly restricted habitat.

The greatest danger to the small mammals is loss of their habitat. It is doubtful whether anything can be done to preserve one endangered species—the spotted bat. We know little about the habitat requirements of the spotted bat. But survival of several other endangered species, including the bald eagle, wolverine, fisher, peregrine falcon, and prairie falcon, depends on available food supply. Small mammals make up the diet of several of these species.

Table 2.- Abundance and usual habitat of small mammals of the Lake Tahoe Region

Species	Abundance	Habitat type ^{1/}
Bats:		
Big brown (<i>Eptesicus fuscus</i>)	Abundant	1, 20
Brazilian free-tailed (<i>Tadarida brasiliensis</i>)	Abundant	1, 20
Hoary (<i>Lasiurus cinereus</i>)	Abundant	1, 20
Long-eared (<i>Corynorhinus rafinesquei</i>)	Abundant	1, 20
Pallid (<i>Antrozous pallidus</i>)	Abundant	1, 20
Red (<i>L. borealis</i>)	Abundant	1, 20
Silver-haired (<i>Lasionycteris noctivigilans</i>)	Abundant	1, 20
Spotted (<i>Euderma maculata</i>)	Endangered	1, 20
Western big-eared (<i>Plecotus townsendi</i>)	Abundant	1, 20
Fringed myotis (<i>Myotis thysanodes</i>)		
Hairy-winged myotis (<i>M. volans</i>)	Abundant	1, 20
Little brown myotis (<i>M. lucifugus</i>)	Abundant	1, 20
Long-eared myotis (<i>M. evotis</i>)	Abundant	1, 20
Small-footed myotis (<i>M. subulatus</i>)	Abundant	1, 20
Yuma myotis (<i>M. yumanensis</i>)	Abundant	1, 20
Beaver:		
Mountain beaver (<i>Aplodontia rufa</i>)	Low	2, 7
Chipmunks:		
Least (<i>Eutamias minimus</i>)	Abundant	6, 14, 17, 18, 19, 20
Lodgepole (<i>E. speciosus</i>)	Abundant	18, 19
Long-eared (<i>E. quadrimaculatus</i>)	Abundant	2, 4, 6, 14, 17, 18
Townsend (<i>E. Townsendi</i>)	Abundant	6, 9, 14 17, 19, 20
Yellow pine (<i>E. amoenus</i>)	Abundant	2, 4, 6, 9, 14, 17
Gophers:		
Mountain pocket (<i>Thomomys monticola</i>)	Abundant	2, 4, 6, 8, 14, 17, 18 19, 20
Northern pocket (<i>T. talpoides</i>)	Abundant	2, 6, 7
Jackrabbits:		
Black-tailed (<i>Lepus californicus</i>)	Few	2
White-tailed (<i>L. townsendi</i>)	Few	2, 4
Marmots:		
Marmot (<i>Marmota flaviventris</i>)	Abundant	1, 1a, 2, 20

^{1/} Numerals refer to serial numbers of habitat types listed on pp. 14 - 15.

Mice:

Brush (<i>Peromyscus boylei</i>)	Abundant	1, 2, 4, 6
Deer (<i>P. maniculatus</i>)	Abundant	1, 2, 4, 6
		7, 9, 14,
		17, 18, 19
Great Basin pocket (<i>Perognathus parvus</i>)	Moderate	4, 6, 14
Long-tailed meadow (<i>Microtus longicaudus</i>)	Abundant	2, 7
Meadow (<i>M. montanus</i>)	Abundant	2, 6, 7
Pinyon (<i>Peromyscus truei</i>)	Abundant	1, 4, 6, 14
Western harvest (<i>Reithrodontomys magalotis</i>)	Abundant	1, 2, 6, 14
Western jumping (<i>Zapus princeps</i>)	Low	2, 7

Moles:

Broad-bearded (<i>Scapanus latimanus</i>)	Abundant	2
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Phenacomys:

Mountain (<i>Phenacomys intermedius</i>)	Low	2
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Pika:

Pika (<i>Ochotona princeps</i>)	Moderate	1, 20
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Porcupine:

Porcupine (<i>Erethizon dorsatum</i>)	Moderate	6, 14, 17, 19
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Rabbits:

Mountain cottontail (<i>Sylvilagus nuttalli</i>)	Abundant	2, 4, 6, 20
Snowshoe (<i>Lepus americanus</i>)	Few	2, 6, 7, 9, 20

Rat:

Bushy-tailed wood (<i>Neotoma cinerea</i>)	Low	1, 6, 17
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Shrews:

Dusky (<i>Sorex obscurus</i>)	Moderate	2, 7
Dwarf (<i>S. tenellus</i>)	Few	7
Northern water (<i>S. palustris</i>)	Low	0, 2, 7
Trowbridge (<i>S. trowbridgei</i>)	Low	2, 7, 9, 14, 17

Squirrels:

Belding ground (<i>Spermophilus beldingi</i>)	Moderate	2, 4, 6, 7
California ground (<i>S. beecheyi</i>)	Moderate	2, 4, 6, 9
Douglas (<i>Tamiasciurus douglasii</i>)	Moderate	14, 17, 18, 19
Golden-mantled (<i>S. lateralis</i>)	Abundant	1, 1a, 6, 9, 14, 17
Northern flying (<i>Glaucomys sabrinus</i>)	Few	6, 9, 14, 17, 18
Western gray (<i>Sciurus griseus</i>)	Moderate	9, 14

Furbearers

Furbearing animals are medium-sized mammals. They have always been attractive specimens whether to Indian hunters, early adventurous trappers, or the modern fur industry. Most of these animals are nocturnal hunters and are not often seen. They depend heavily on the well being of animals in the small-mammal group for their food supply. Their population trends can be correlated closely with the populations of the small mammals.

The range of these furbearing animals varies widely (table 3); some are found throughout the Tahoe Region, but others are found only in certain streams and lakes. Among the 15 species in the region, only three—raccoon, pine marten, and coyote—are abundant or found in moderate numbers. Four of the 15 are considered rare and endangered species: wolverine, pine marten, fisher, and Sierra red fox. Likewise, all but four species (raccoon, two skunks, and coyote) have been intolerant of man's disturbance of their habitat.

Some furbearers, notably the coyote and bobcat, compete with man; others do not. For their infringement on man's activities—chiefly by killing his domestic animals and fowl—they pay by being constantly hunted. The coyote can and does live in close association with man and seems to thrive despite constant hunting. Within areas occupied by man, the skunk is highly tolerant of disturbance. Weasels are wilder species and would prefer to live outside man's domain. They also infringe on man's scheme of life by killing some of his domesticated animals, but they are less destructive than the coyote and bobcat.

If the furbearers' needs for habitat are adequately provided for, they can and will survive—even the rare and endangered species.

Table 3.- Furbearing mammals of the Lake Tahoe Region

Species	Range	Habitat type ^{1/}	Population status
Beaver (<i>Castor canadensis</i>)	Certain lakes and streams	0, 7	Decreasing
Bobcat (<i>Lynx rufus</i>)	Rocky areas	2,4,6,7,9	Stable
Coyote (<i>Canis latrans</i>)	Throughout the region	All	Stable
Sierra red fox (<i>Vulpes fulva</i>)	Throughout the region	1, 19, 20	Endangered
Fisher (<i>Martes pennanti</i>)	Below 7500 ft.	17	Endangered
Marten, pine (<i>Martes americana</i>)	Up to 7500 ft. in winter; to top in summer	17	Endangered
Mink (<i>Mustela vison</i>)	Throughout the region	All	Stable
Muskrat (<i>Ondatra zibethica</i>)	Mouths of streams	0, 7	Stable
Otter (<i>Lutra canadensis</i>)	Throughout the region	0, 7	Stable
Raccoon (<i>Procyon lotor</i>)	Throughout the region	0, 7, 9, 17	Have increased
Spotted skunk (<i>Spilogale gracilis</i>)	Rocky, dry, brushy areas	6	Stable
Striped skunk (<i>Mephitis mephitis</i>)	Throughout the region	7, 17	Stable
Weasel, shorttail (<i>Mustela erminea</i>)	Scattered	2, 6, 17	Stable
Weasel, longtail (<i>M. frenata</i>)	Throughout the region	All	Stable
Wolverine (<i>Gulo luscus</i>)	Throughout the region	1, 20	Endangered

^{1/} Numerals refer to serial numbers of habitat types listed on pp. 14 - 15.

BIRDS

Birds in this region are conveniently divided into three classes: **waterfowl** (e.g., ducks, geese, and coots), 22 species; **upland game** (e.g., quail, grouse, and doves), 4 species; and **other birds** (e.g., robins, woodpeckers, and eagles), 178 species.

Waterfowl

The 22 species of waterfowl in the Lake Tahoe Region (table 4) are all within the same family. They need basically the same form of wet habitat and have the same moderate level of tolerance to disturbance. All these species except the smaller Canada goose, which is found only in the Tahoe Marsh, range the whole lake basin.

All the birds in this group have stable populations. This condition results from the management and protection they have received throughout the continent for many years. In addition to being favored by man's current benevolence, these waterfowl have the good fortune of being mostly plant eaters; hence they have had minimal exposure to chemical pesticides that accumulate through animal food chains.

Table 4. – Abundance of species of waterfowl in Lake Tahoe Region

Species	Abundance
American widgeon (<i>Mareca americana</i>)	Few
Barrow's goldeneye (<i>Bucephala islandica</i>)	Few
Bufflehead (<i>B. albeola</i>)	Few
Canada goose, Lesser (<i>Branta canadensis parvipes</i>)	Moderate
Canada goose, Western (<i>B. canadensis moffitti</i>)	Abundant
Canvasback (<i>Aythya valisineria</i>)	Few
Cinnamon teal (<i>Anas cyanoptera</i>)	Moderate
Common goldeneye (<i>Bucephala clangula</i>)	Few
Common merganser (<i>Mergus merganser</i>)	Abundant
Gadwall (<i>Anas strepera</i>)	Moderate
Greater scaup (<i>Aythya marila</i>)	Few
Green-winged teal (<i>Anas carolinensis</i>)	Moderate
Hooded merganser (<i>Lophodytes cucullatus</i>)	Few
Lesser Scaup (<i>Aythya affinis</i>)	Few
Mallard (<i>Anas platyrhynchos</i>)	Abundant
Pintail (<i>A. acuta</i>)	Abundant
Redhead (<i>Aythya americana</i>)	Few
Ring-necked duck (<i>A. collaris</i>)	Abundant
Ruddy duck (<i>Oxyura jamaicensis</i>)	Moderate
Shoveler (<i>Spatula clypeata</i>)	Few
Snow goose (<i>Chen hyperborea</i>)	Moderate
Wood duck (<i>Aix sponsa</i>)	Few

Twelve of these waterfowl pass through the Tahoe Region while en route to and returning from their wintering grounds. The other 10 species nest in the Lake Tahoe Region, and three of these 10 are year-round residents.

Waterfowl are easily observed and furnish pleasure to many persons who visit the lake shoreline. All of these birds are limited to an aquatic environment, and the 10 species that nest at Tahoe must use the marsh as a nesting habitat. Therefore, it is imperative that marshlands be preserved to allow perpetuation of their population within the Lake Tahoe Region.

Interrelationship between waterfowl and other wildlife groups is minor. However, many of the furbearers and the raptors prey on some of these species whenever they can. Moreover skunks, raccoons, magpies, jays, and certain domestic animals destroy the nests of waterfowl.

UPLAND GAME BIRDS

Four species of game birds live in the dry uplands of the Lake Tahoe Region (table 5). Two species, the band-tailed pigeon and mourning dove, are migratory and do not remain here during the winter. The other two species, mountain quail and blue grouse, are considered residents even though they do not spend the entire year in this immediate area. The blue grouse moves to lower elevations in spring, summer, and fall, but spends the winter at higher elevations. The critical habitat of this bird is the grassland, where it rears its young. The mountain quail moves to lower elevations for the winter; it is the only species of these four for which there is moderate abundance.

All four species are seedeaters and depend on the immediate year's crop for much of their sustenance. They can benefit from habitat manipulation, provided it is done properly. All four species have moderate tolerance to disturbances, but the mountain quail and blue grouse have been most adversely affected. Various land disturbances have isolated meadowlands necessary for brooding and nesting and have decreased the total acreage of valuable food-producing areas. These birds are part of the food chains for most of the furbearers, raptors, and the mountain lion.

The future of the upland game birds depends on the management of the wildlands that surround the developed portion of the Region. If they are given careful attention during the process of any land disturbances that might affect them, they should be able to maintain and possibly increase their numbers.

Table 5. — Abundance, range and habitat of upland game birds of the Lake Tahoe Region

Species	Abundance	Range	Habitat type 1/
Mourning dove 2/ (<i>Zenaidura macroura</i>)	Few	Mostly below 7000 feet	2, 4, 6
Blue grouse (<i>Dendragapus obscurus</i>)	Few	Throughout region	2, 17, 18
Band-tailed pigeon (<i>Columba fasciata</i>)	Few	Throughout region	6, 9, 14, 17
Mountain quail (<i>Oreotyx pictus</i>)	Moderate	Throughout region	2, 4, 6

1/ Numerals refer to serial numbers of habitat types listed on pp. 14 - 15.

2/ The Tahoe Region is outside the normal ranges of these two migratory species. They are listed here because they are frequently present in limited numbers except in winter.

Other Birds

This group of 178 species (table 7) has the unusual, if not perplexing, distinction of being so close to overpopulation that any further crowding of its now restricted habitat will generate a decline in numbers. This fragile balance between numbers and habitat may be upset easily by any large-scale destruction of Lake Tahoe's marshland habitat, which now supports 60 species of birds.

Eighty-six of the 178 species require herbaceous (marsh, meadow, and grassland) habitat. This habitat type is used for nesting by blackbirds, for feeding areas by the hawks, and for cover by the lark. The birds that will be most affected by human disturbances are the 46 species that are limited exclusively to a single type of habitat. Thirty-seven other bird species, plus 22 waterfowl, reside in the single-habitat type provided by shoreline marshes.

This latter category consists of 47 families. Their diet includes small mammals, insects, and weed seeds. Nearly all these bird species are generally tolerant to human disturbances. Some types, such as the Steller's jay and calliope hummingbird, have adapted to urban living and use the bird feeders provided by many people. Other species, such as the robin and evening grosbeak, benefit from lawns, trees, and shrubs planted for landscaping. The pileated woodpecker and the shore and wading birds have been driven out of their habitat by urbanization and have been unable to adapt to a new environment.

The bird families in this group that are mainly beneficial to man include loons, grebes, hawks, herons, owls, woodpeckers, flycatchers, jays, thrushes, warblers, blackbirds, and finches. They destroy harmful rodents and destructive insects, and they consume quantities of weed seeds. They also furnish many hours of enjoyment to bird watchers, whose numbers have flourished during the last 5 years.

WILDLIFE HABITAT

Knowing the habitat requirements of wildlife is just as important to planners as knowing the number and characteristics of species that live in the Region. This knowledge is needed to evaluate what tolerance wildlife has toward disturbances created by man and his activities.

Scientific study of vegetation in California several years ago resulted in definition and description of nearly 30 specific types that wildlife inhabit. Ecologists who have studied the vegetation in the Lake Tahoe Region have found 13 of these types here. For convenience, we are using the code names and numbers of these types throughout this publication. The key to interpreting the numbers used in the "Habitat type" columns in the several tables is given below.

Water (0) Lakes, streams, ponds, and reservoirs.

Bare ground (1) Practically devoid of vegetation because of limitations imposed by natural, physical, or climatic factors; e.g., windblown areas; avalanche chutes; talus slides, and scree slopes.

Disturbed (1a) Practically devoid of vegetation because of man-caused or related factors.

Herbaceous (2) Principally low-growing, nonwoody grasses or forbs, but may include scattered tree or shrub overstory; examples: meadows, marshes, grasslands, willow runs, aspen groves, and alder groves.

Sagebrush (4) Mainly sagebrush in association with other shrub species such as bitterbrush, whitethorn, and scrub oak; generally on southern exposure or on poor or shallow soils. Plants are openly spaced and vary from 2 to 4 feet in height; a thin stand of bunchgrass usually is present.

Montane chaparral (6) Areas of shrub species other than sagebrush and riparian shrubs, generally at elevations of 6,000 to 9,000 feet.

Riparian shrubs (7) Generally found adjacent to wet areas and stream courses; examples: willow runs and zones bordering wet meadows.

Broadleaf (9) Open stands of broadleaf trees, predominantly aspen and alder, but also black cottonwood; some shrubs are present.

Pine (14) Pure pine stands consisting mostly of Jeffrey, ponderosa, and sugar pines.

Mixed conifer (17) Mixed pine and fir are the dominants; lodgepole and white pine are associated with Jeffrey pine and fir.

Fir (18) Red and white fir, individually or together, are the dominant timber trees.

Lodgepole (19) Thickets of lodgepole pine occur as dominants and can readily be identified and typed as such.

Alpine (20) High-elevation, noncommercial, timber stands consisting of juniper, hemlock, western white pine, and white bark pine; generally found near timberline.

ISSUES AND PROBLEMS

In *Our Wildlife Legacy*, Durward Allen distinguishes two kinds of property: "That to which we have title as individuals and that which we hold in community." The 275 species of wildlife in the Lake Tahoe Region are public possessions held in community title. Not only are they a valuable resource, but they can also serve as a barometer of change if they are studied and observed. They perform an essential role in the ecosystem of the Lake Tahoe Region.

This wildlife resource lives on the 202,000 acres that comprise the region. Title to this acreage varies: some is in public ownership; some is held in trust by conservation organizations; and the remainder is owned by private individuals and organizations.

Public land managers are required by law to manage and protect wildlife. Their responsibilities include the protection of a community possession on community property. A private landowner, however, is not legally required to accord such protection to wildlife. This discrepancy creates a dilemma for persons who are concerned about the values of wildlife.

Problems and issues in protection and management vary in intensity and urgency. The critical issue is how to maintain wildlife populations in the face of intrusion by man--how to resolve the constant tug-of-war between human and wildlife populations. Any plans for development of the region must consider all factors affecting environmental quality, and these must include any effects on wildlife and its habitat. Planners, developers, land managers, and researchers all need to set priorities on what can and should be done.

Two problems--probably basic and applicable to all categories of wildlife--are: (1) our lack of complete information about their habitats, habitat needs, and activities; and (2) public apathy toward developing and financing programs for research and adequate wildlife management. Other problems and issues, perhaps not as broad-gauged and all-encompassing, also demand answers:

Wildlife Category: Large Mammals

The Issues: Are populations below the optimum levels? Are most of the current laws and regulations governing the management of large mammals emotionally oriented?

When a man or his family decides to build a vacation home in a forested area as a retreat from typical city life, they take it for granted that the new house will include many if not all of the comforts of their urban residence. The house and garage (or carport) are an intrusion on the natural habitat of large mammals, as are the consequent additional noise and new smells generated by fireplace smoke and gasoline engine fumes. Areas of wildlife habitat have shrunk because of increased grazing by livestock in formerly remote areas. Loss of watering places because of alteration of the forest, lack of restriction on all kinds of construction (e.g., residences, business buildings, highways, airports, and golf courses, to name a few), and freedom accorded to domestic pets--all subtract from the natural habitat of wildlife. Moreover, wildlife populations are further controlled by restrictive legislation that regulates such things as seasonal hunting permits and types of hunting--which means, in short, that wildlife is being controlled in the political arena rather than by game biologists who know the needs of the animals and birds.

Wildlife Category: Small Mammals

The Issues: How vital are small mammals as links in the wildlife food chain? Are these species detrimental to man's interest in and concern for wildlife values?

Overpopulation of some species can be attributed to man's changes of the environment and to his outdoor activities. Climate and availability of food are prime factors in maintaining the natural habitat of these animals.

Wildlife Category: Furbearing Mammals

The Issues: Are populations of each species below optimum numbers? What habits of some species interfere with and damage certain human activities? How much consideration do these animals merit in regional planning?

When some furbearers become too numerous they can damage property considerably. And a few furbearers, like some small mammals, are disease-carrying vectors that are potential hazards to public health.

Wildlife Category: Waterfowl

The Issues: What are the special habitat needs of waterfowl? How can these needs be met so as to sustain optimum populations? Are the differences in aims between species-preservation groups and hunting groups irreconcilable?

In its natural state, Lake Tahoe offers a limited habitat for waterfowl. This habitat is affected by activities such as mosquito abatement, which kills other insects as well as the target insect; loss of wetlands through reclamation projects; freedom of pets to roam; and construction of sewer, power, and other types of utility lines through preferred habitat sites.

Wildlife Category: Upland game birds

The Issues: Are populations of native species below optimum levels? What environmental problems are created by the introduction of exotic species to supplement native species?

The habitat of upland game birds in the Lake Tahoe Region has always been poor—even before the intrusion of man. Introduction of exotic bird species has resulted in reduction of the native populations. Once introduced birds become acclimated to their new surroundings, they begin to multiply and compete directly with native species for habitat and food.

Wildlife Category: Other birds

The Issues: How can balanced populations and a variety of species be maintained? Are the important links in the food chain fulfilled by these species properly recognized in planning?

Unbalanced populations and a limited composition in species are related directly to man's environmental changes and to his activities. This imbalance can have detrimental effects. An excessively large population of some species can, for example, damage some property values and compete excessively for food with other birds.

Wildlife Category: Rare and endangered species

The Issue: What can and should be done to insure that these species do not become extinct?

These birds and mammals are singled out because of the growing likelihood of their extinction unless steps are taken to preserve them. They have shown that they cannot tolerate environmental disturbances. They no longer have the food sources and habitat condition they once enjoyed.

Before any of these issues can be resolved and the attendant problems taken up, it is vital to

consider them in the larger context of numerous biological facts of life. The planner, the developer, the manager, and the researcher ought to know about the relations of living organisms to ecological processes that form the biological network, about how wildlife react to environmental disturbances, about the trends in animal and bird populations, and about the special needs of rare and endangered species.

CYCLICAL CHANGES AND ADJUSTMENTS

The Biological Network

In their natural state, all flora and fauna are intricately bound to ecological processes that form what is called the **biological network**. The balance of this relationship between living organisms is an indispensable key to wildlife survival. This network involves a constant cyclical change from organic to inorganic life and varies, depending upon the components (such as soil, vegetation type, and wildlife species) which determine the levels of interaction. These basic cycles of life are often called **food chains**.

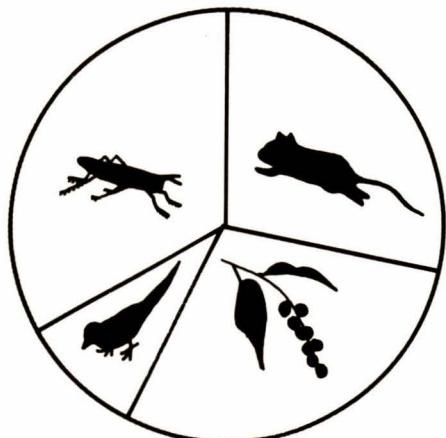
Within each food chain are four basic levels of activity or feeding groups, called **trophic levels**. Each level is seemingly prepared for assimilation by the next higher level:

- The first level ("the producers") is the green plant community, which uses light to manufacture food within microscopic plant cells by the process called *photosynthesis*.
- The second level ("the herbivores") consists of consumers and includes insects that feed on plants. This is the most significant level in the biological network, for without the herbivores no higher trophic level would be possible. Grasshoppers, small mammals, upland game birds, hoofed animals, and waterfowl are the members of this group.
- The third level ("the carnivores") includes consumers of flesh and animals that feed directly upon the herbivores. Hawks, eagles, owls (raptors), many of the furbearers, and the mountain lion make up this group within the Lake Tahoe Basin. Some animals fit into the biological network by feeding on both flesh and plant life. They are "the omnivores" and can be found in the herbivore and carnivore trophic levels. The fox, raccoon, bear, and coyote are examples of omnivores.
- The fourth level ("the decomposers") consists chiefly of micro-organisms that chemically break down dead plants and animals into simpler substances to be used by "the transformers," commonly called bacteria. The bacteria alter these simple substances, which eventually are returned to the soil as natural fertilizers. These broken-down substances are readily consumed by the producers. Thus, these substances begin anew their journey through the biological cycle. A typical food chain for the Lake Tahoe Basin is shown in figure 1.

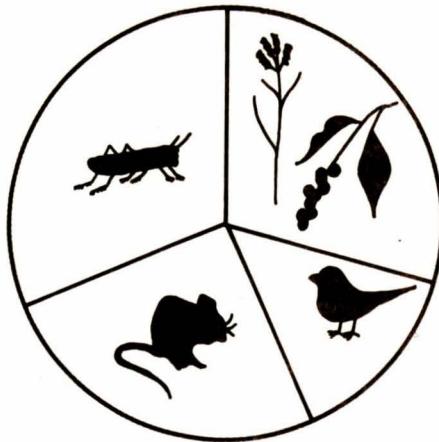
A secondary concept of the biological network is that the food habits of many animals are influenced by seasonal availability of food.

Some species leave the Lake Tahoe Basin as variety and availability of food dwindle. Others simply adjust their eating habits to consume what is available. The coyote, a common omnivore with a highly flexible diet, is a prime example of an animal that adjusts his eating habits.

SEASONAL FOOD AVAILABILITY



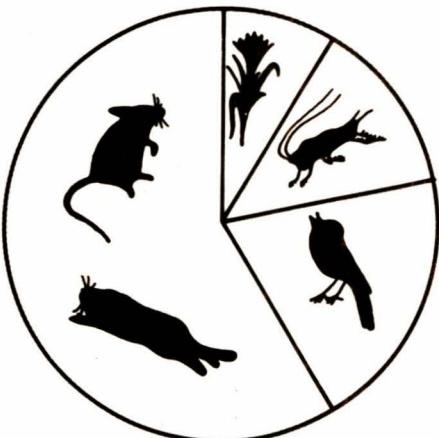
SUMMER



FALL



WINTER



SPRING

A secondary biological concept of the biological network to be noted is that the food habits of many animals are influenced by *seasonal food availability*.

Some species leave the Lake Tahoe Basin as food variety and availability dwindles. Others simply adjust their food habits to consume what is available. The coyote, a common omnivore, with a highly flexible diet, is a prime example of an animal within the latter group.

DISTURBANCES AND IMPACTS

When shortages of wildlife population appear, it is necessary to study the biological network and identify the cause. It may be a cyclical disease, but most often some environmental disturbance of habitat caused the change and produced this definite effect upon the ecosystem.

Environmental Disturbances

Eleven types of environmental disturbance to habitat in the Lake Tahoe Region have been identified. What they are and what effects they have on the ecosystem are summarized as follows:

1. **Compaction of surface soil**, or reduction of open pore space: Restricts or interrupts leaching of phosphorus, nutrients, and carbon into the soil. Compaction of surface soils results in destruction of nitrogen-fixing soil bacteria and prevents exchange of water between land and the atmosphere.
2. **Clearing**, or removal of surface vegetation: Reduces or eliminates photosynthesis, vegetative transpiration, soil nutrient supply, and nitrogen-fixing bacteria. Plant decay stimulates an unnatural increase of the carbon input to the soil and increases water runoff.
3. **Grading**, or soil-moving operations, both surface and subsurface: Releases nitrogen, carbon locked in the new soil horizons, and phosphorus stored in rock deposits. Grading alters normal patterns of surface runoff and percolation. When the humus layer is disturbed, nutrients are lost.
4. **Impervious surfacing**, or placing impervious material on soil surface: Cuts off the supply of carbon compounds, nitrogen, oxygen, and nutrients from the soil. The resulting elimination of water percolation into the soil increases the quantity and velocity of surface runoff.
5. **Noise** exceeding 75 decibels at a distance of 100 feet and presence of noise where it intrudes on relatively quiet areas: Most animal species react negatively to uncommon noise within or adjacent to their habitat.
6. **Motion**, or movement associated with vehicles and people: Most animal species react negatively to uncommon motion within or adjacent to their habitat.
7. **Climatic conditions** and associated changes: Flora and fauna native to the region undergo genetic assimilation to normal climatic changes. Material cycling, including carbon and water nutrients, is almost at a standstill, and most life species must survive by adjusting.
8. **Insect and disease operations** to prevent epidemics of pathogens and pests that damage flora and fauna: Insect infestations can interfere with the carbon cycle. Successful control increases the return of nutrients to the soil, but the control operation is an intrusion.
9. **Introduced vegetation**, or vegetative species that do not occur naturally in the region: These species may be susceptible to infestations of insects and disease. To become established, most introduced species require excessive growth stimulants and water. And when climatic variations occur, their adjustment to the cyclical process may be difficult or impossible.

10. Use of chemicals, including applications to fertilize soil and eliminate mosquitoes: Extensive use of chemical growth-stimulants can alter or supplant the normal flow of nutrients. If plant loads exceed normal soil capacities, biochemical cycles are interrupted, and their effectiveness in the biological network is reduced.

11. Prescribed burning, elimination of vegetative debris and litter by controlled fire: Quickly releases the carbon from the protoplasm of plants and nutrients found in litter; momentarily cuts off the soil's oxygen supply; temporarily destroys organisms living in the soil. Burning, if not properly controlled, can destroy the nitrogen-fixing bacteria in the soil.

Among the 11 types of disturbances, only two—noise and motion—do not alter the biochemical cycles. Four types of disturbance—clearing, grading, impervious surfacing, and climatic changes—alter all of the five basic cycles: carbon, nitrogen, oxygen, nutrient, and water. The other types of disturbances affect fewer of them.

Susceptibility to Change

One important task in this study was to evaluate the susceptibility of wildlife to these environmental disturbances. Three ratings were used to show differing degrees of susceptibility to disturbance:

H = High capability to withstand the disturbance. Most species in this category showed little or no response to the disturbance.

M = The species can tolerate the disturbance, but the population trend turns downward. Most species receiving this rating responded unfavorably to the disturbance but could adjust; the exceptions were species having territorial traits.

L = Low capability to withstand disturbance. Most species in this category react; population trend is downward.

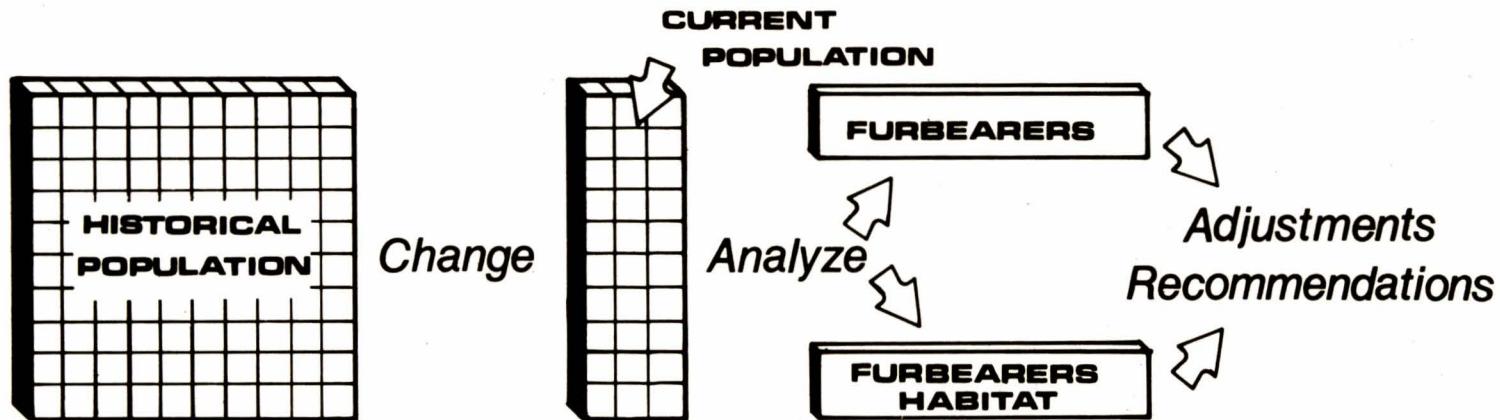
The following chart shows the general reaction level of each wildlife category to the 11 types of disturbance identified in the Lake Tahoe Region. Most species in the categories of "Small mammals" and "Other birds" can adapt to the effect of disturbances. Other species have not provided any evidence that they have adapted. There was no measurable response to compaction of surface soil or to the covering of soil by impervious surfacing.

Type of disturbance	Wildlife category					
	Large mammals	Small mammals	Furbearers	Upland game birds	Waterfowl	Other birds
Surface soil compaction						
Clearing	L	M	L	L	L	M
Grading	L	M	L	L	L	M
Impervious surfacing						
Noise	L	M	L	L	M	M
Motion	L	M	L	L	L	M
Climatic changes	M	M	H	L	M	M
Insect and disease control operations	H	M	M	L	L	L
Introduced vegetation						
Use of chemicals	H	M	M	L	L	L
Controlled burning	L	L	L	L	H	H

ADJUSTMENT:
HABITAT AND POPULATION

"On land and in water life exists in measured quantities true to the principle of cause and effect - Rules we didn't make decide the outcome of our work." Durward L. Allen

The abundance, distribution, and/or status of a wildlife species are usually the first environmental determinants affected when a change occurs. When this transformation takes place, the biologist can either trace the species or study the habitat for clues and, eventually, find the cause for the change.



In making the species analysis, a wildlife biologist usually finds disease, parasites or cyclic fluctuations as the most common population adjusters.

In analyzing a habitat, he looks for disturbances within the habitat, which invariably alter the food supply and the micro-climate. These alterations affect the abundance and condition of a species and, eventually, determine the species' chance for survival.

MOVEMENT AND POPULATION TRENDS

Wildlife species react to impacts upon their environment. Their efforts to relocate and the distances they can move greatly depend on their mobility and adaptability. This change is most commonly expressed in terms of population trends and range.

Many birds and mammals are **territorial**; that is, they have a plant and animal community association of limited size. They depend upon that community to remain balanced in availability of food and cover. Other birds and mammals migrate when climatic changes severely alter their habitat and cause food shortages. A third group of birds and mammals has **limited mobility**. They can usually adapt to habitat changes by either moving a short distance to another plant and animal community or by changing their food preferences in the altered habitat.

Providing a proper habitat for the wildlife in residence is a job for the trained wildlife specialist.

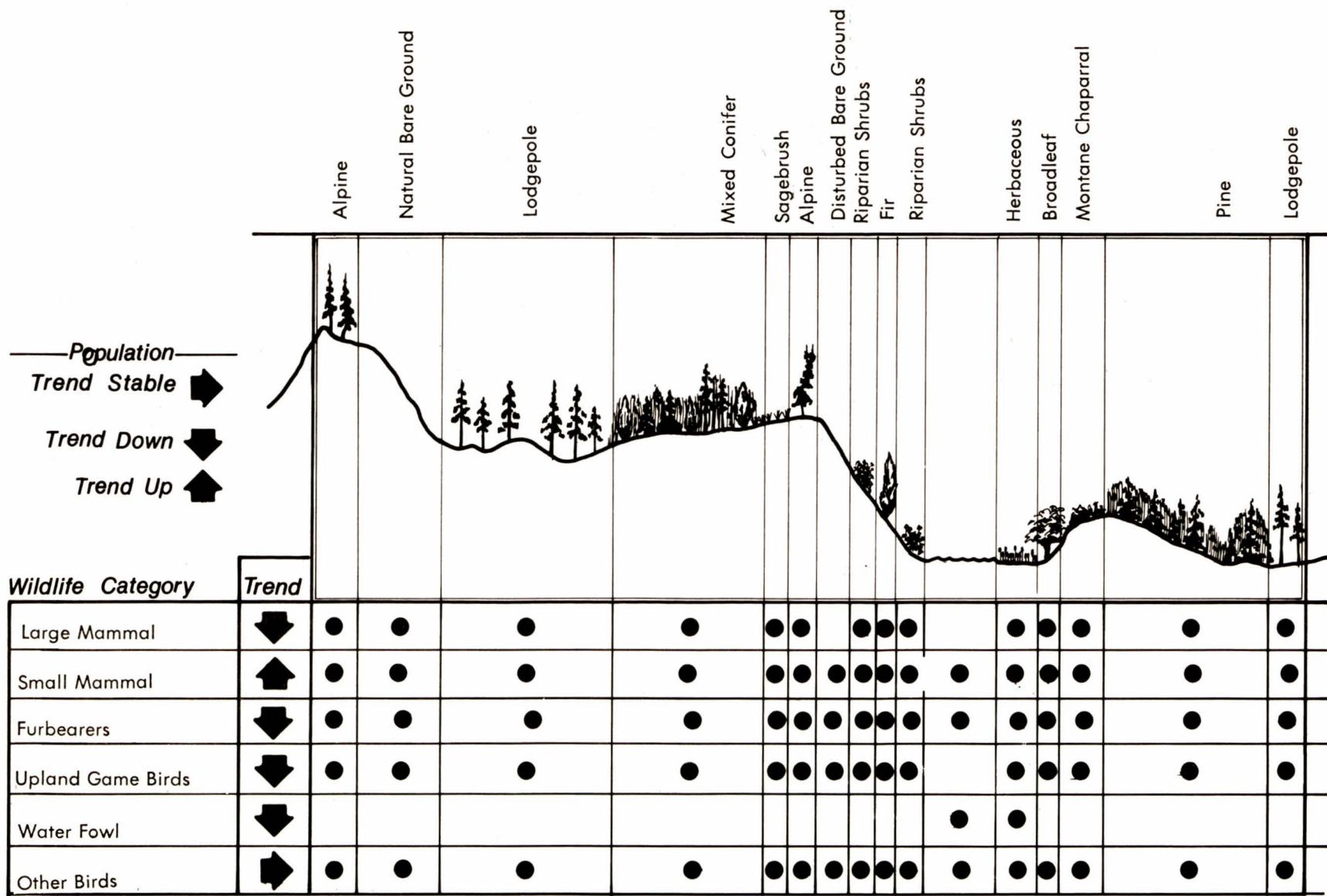
Often he may have neither the resources nor time to analyze immediate habitat conditions when a change in population occurs. But over the years specialists have been able to observe and count wildlife populations and analyze population trends. These trends are useful indicators of habitat conditions—especially for species that are territorial or limited in mobility.

The population trends for the six categories of wildlife surveyed in this report appear to be as follows:

Large mammals: downward
Small mammals: upward
Furbearers: downward
Upland game birds: downward
Waterfowl: downward
Other birds: stable

Downward = decrease in numbers
Upward = abundance
Stable = no great change

The following figure shows where species from the six categories of wildlife are found in the 13 types of habitat or communities that were identified in the Lake Tahoe Region.



—In the Lake Tahoe Region, species from all wildlife categories—except waterfowl— are found in nearly all of the 13 habitat types or communities that were identified.

RARE AND ENDANGERED SPECIES

The terms "rare," "endangered," "peripheral," and "status undetermined" are applied to wildlife species that have small populations and cannot increase them by natural means. In this report, we have used these definitions of the four terms:

Peripheral: Wildlife that occasionally enter the Lake Tahoe Region because it is on the edge of the animal's natural habitat range. The species may be rare and endangered in the United States as a whole, but is not considered so within the boundaries of its range. Peripheral species should be given special attention so that they can be preserved in the Region.

Undetermined: Species and subspecies for which little information is available about population status. Much of our understanding is based on assumption, and more study is needed.

Rare: Species and subspecies not yet threatened with extinction, but found in such small numbers throughout its range that it may be considered endangered if its environment deteriorates.

Endangered: Species or subspecies whose prospects for survival and reproduction are in immediate jeopardy. Extinction of these species may possibly be averted if they are helped in their struggle for survival.

In the Lake Tahoe Region, 13 wildlife species have an undetermined, rare, or endangered status (table 6). Nearly all, except possibly the spotted bat, are highly intolerant of man's activities. Most of these species are predators; the exceptions are the spotted bat and pileated woodpecker.

The rare and endangered birds of prey are the golden and bald eagles, and the prairie and peregrine falcons. The status of the osprey is undetermined.

The rapidly decreasing numbers of all these birds can probably be attributed to two factors: what until recently was the wide use of chemical insecticides, and the continually receding boundaries of natural habitat for the species.

Most of these species have shown lack of adaptability to environments predominantly human; therefore their populations continue to decline at an alarming rate. The fisher, marten, and wolverine exemplify the plight of these "non-adaptive" species. The fisher and marten are products of dense, mature conifer stands; the wolverine's habitat lies between the conifer and alpine vegetative zones. None of these three furbearers can cope with a large influx of people into the high country.

The future of the pileated woodpecker appears to be brighter than that of the eagles and falcons. This bird lives in mature dense stands of conifer, and fortunately there are areas within the Desolation Wilderness and Upper Truckee River that will satisfy its habitat needs. On the other hand, the Anthony green heron is threatened because its habitat, Lake Tahoe's marshland shores, is rapidly being converted to man's uses.

This wildlife category includes some fascinating species. The falcons, for example, are among the fastest birds in the world. All of these species are unique, and it has taken thousands of years for their evolution into a bird or animal that fits a particular set of ecological conditions. We need to recognize that these and other rare and endangered species must have special protection if they are to survive.

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Table 6. — Range, habitat type, and population status of rare and endangered species in the Lake Tahoe Region.

Species	Range	Habitat	Status
Spotted bat <i>Euderma maculata</i>	Throughout	2, City	Endangered
Bald eagle <i>Haliaeetus leucocephalus</i>	Throughout	0, 2, 14, 17, 19	Endangered
Golden eagle <i>Aquila chrysaetos</i>	Throughout	2, 14, 17	Endangered
Peregrine falcon <i>Falco peregrinus</i>	Throughout	1, 2, 4, 7	Rare
Prairie falcon <i>Falco mexicanus</i>	Basinwide	2, 4, 6	Rare
Fisher <i>Martes pennanti</i>	West side	18, 17	Rare
Sierra red fox <i>Vulpes fulva</i>	Difficult to verify	2, 4, 6, 7	Rare
Anthony's green heron <i>Butorides virescens</i>	Basin	0, 2	Undetermined
Pine Marten <i>Martes americana</i>	West side	18	Undetermined
American osprey <i>Pandion haliaetus</i>	Basin	0, 7	Undetermined
Wolverine <i>Gulo luscus</i>	Timberline and above	1, 20	Rare
Pileated woodpecker <i>Dryocopus pileatus</i>	Throughout	2, 17, 19	Undetermined

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SUMMARY

Two hundred seventy-five species of wildlife inhabit the Lake Tahoe Region; of these 72 are mammals and the rest are birds. Except for the 22 species of waterfowl, all this wildlife lives in most of the 13 vegetative types of habitat identified here. Several species of birds and animals in each class are considered to be rare or endangered.

The basic problem in maintaining populations of wildlife and quality in their habitat is the constant tug-of-war between the wildlife's needs and man's desires. Several problems and issues related to both wildlife management and land use must be considered in planning orderly development of this area. These include the relation of living organisms to ecological processes; the effects of environmental disturbance on wildlife; trends in animal and bird populations and patterns of their movements; and the needs of the rare and endangered species.

Wildlife is an important element in the natural ecosystem; environmental balance eliminates both poison and waste. Permanent disturbances affect wildlife and alter the balance of the ecosystem.

Urbanization inevitably affects wildlife adversely and in varying degrees. This results more from man's lack of knowledge and understanding of the animals' needs than from deliberate intent to harm. Few provisions in the law require the preservation of wildlife in planning land use. Research of wildlife and its habitat must be expanded and coordinated with studies of other resources and land uses. Likewise, more research on habitat requirements of endangered species is needed. Only one wildlife biologist is stationed in this region; more are needed to accomplish the needed research listed above.

Herbaceous habitat types and flood plains parallel to stream courses have deteriorated because of disturbance. Nesting sites and brooding areas of waterfowl and shorebirds need protection if these species are to maintain their numbers.

Habitat for upland game birds is very poor, and native species cannot maintain, much less increase, their numbers.

Use of chemical pesticides has affected wildlife adversely.

Present systems of removing forest products from the land need review; guidelines that allow for preservation of habitat features (nesting trees, food sources, watering places, and cover) need to be prepared.

Native species of wildlife have survived better than introduced species.

Road kills of animals have not been numerous; but as habitat encroachment continues and vehicular traffic increases, corridors for wildlife movement will have to be identified and protected.

Conservation organizations, chapters of the Audubon Society, and wildlife federations have been only minimally involved in wildlife studies in this Region; effort should be made to increase this participation. Programs of information and education to increase public understanding of wildlife

needs are lacking. The result is that public concern for management and protection of wildlife ranges from total apathy to great concern. This makes it difficult for wildlife biologists to gain support for recommended programs.

Ten of the eleven identified types of environmental disturbance affect wildlife--and unfavorably. Large animals have least capability for adjusting to disturbance of habitat. The two most important factors in survival of wildlife species are mobility and ability to adapt to environmental change.

APPENDIX

Table 7. — Abundance, tolerance, habitat type, and population status of birds in the Lake Tahoe Region ^{1/}

Species	Abundance	Tolerance	Habitat type ^{2/}	Population status
American Avocet <i>Recurvirostra americana</i>	Few	Intolerant	0, 2	Stable
American Bittern <i>Botaurus lentiginosus</i>	Few	Intolerant	0, 2	Stable
Brewer's Blackbird <i>Euphagus cyanocephalus</i>	Abundant	Tolerant	1a, 2	Stable
Red-winged Blackbird <i>Agelaius phoeniceus</i>	Abundant	Intolerant	2	Stable
Tri-color Blackbird <i>A. tricolor</i>	Abundant	Intolerant	2	Stable
Yellow-headed Blackbird <i>Xanthocephalus xanthocephalus</i>	Abundant	Intolerant	2	Stable
Mountain Bluebird <i>Sialia currucoides</i>	Moderate	Tolerant	2	Stable
Western Bluebird <i>S. mexicana</i>	Moderate	Tolerant	1, 2, 6,	Stable
Lazuli Bunting <i>Passerini amoena</i>	Moderate	Tolerant	6, 7, 9	Stable
Common Bushtit <i>Psaltriparus minimus</i>	Few	Tolerant	9, 14	Undetermined
Yellow-breasted Chat <i>Icteria virens</i>	Few	Tolerant	7	Undetermined
Mountain Chickadee <i>Parus gambeli</i>	Few	Tolerant	14, 17, 18, 19	Undetermined
Coot <i>Fulica americana</i>	Abundant	Tolerant	0, 2	Stable
Double-crested Cormorant <i>Phalacrocorax auritus</i>	Few	Tolerant	0, 2	Stable
Brown-headed Cowbird <i>Molothrus ater</i>	Moderate	Tolerant	1a, 2, 7	Stable

1/ Exclusive of birds listed in preceding tables. Except for a few waterfowl and shorebirds, most species are found throughout the Region.

2/ Numerals refer to serial numbers of designated habitat types listed on pp. 14-15.

Sandhill Crane <i>Grus canadensis</i>	Few	Intolerant	2	Endangered
Brown Creeper <i>Certhia familiaris</i>	Moderate	Intolerant	14, 17, 18	Stable
Red Crossbill <i>Loxia curvirostra</i>	Few	Tolerant	14, 17, 18	Undetermined
Long-billed Curlew <i>Numenius americanus</i>	Few	Intolerant	0, 2	Stable
Dipper (Water Ouzel) <i>Cinclus mexicanus</i>	Abundant	Tolerant	0, 7	Stable
Long-billed Dowitcher <i>Limnodromus scolopaceus</i>	Few	Intolerant	0, 2	Stable
Bald Eagle <i>Haliaeetus leucocephalus</i>	Few	Intolerant	0, 2, 7	Endangered
Golden Eagle <i>Aquila chrysaetos</i>	Few	Intolerant	1, 1a, 2, 4, 6, 7, 9, 14, 17, 19, 20	Endangered
Common Egret <i>Casmerodius albus</i>	Few	Intolerant	0, 2	Stable
Snowy Egret <i>Leucophoyx thula</i>	Few	Intolerant	0, 2	Stable
Peregrine Falcon <i>Falco peregrinus</i>	Very Few	Intolerant	2, 4, 6, 7	Endangered
Prairie Falcon <i>F. mexicanus</i>	Very Few	Intolerant	2, 4, 6	Endangered
Cassin's Finch <i>Carpodacus cassini</i>	Moderate	Tolerant	17	Stable
Gray-crowned Rosy Finch <i>Leucosticte tephrocotis</i>	Few	Intolerant	20	Stable
Purple Finch <i>Carpodacus purpureus</i>	Moderate	Tolerant	17	Stable
Red-Shafted Flicker <i>Colaptes cafer</i>	Abundant	Tolerant	7, 9, 14, 17, 18	Stable
Ash-Throated Flycatcher <i>Myiarchus cinerascens</i>	Very Few	Tolerant	9	Undetermined

Dusky Flycatcher <i>Empidonax oberholseri</i>	Few	Tolerant	14, 17, 18	Stable
Hammond's Flycatcher <i>E. hammondi</i>	Few	Tolerant	18	Stable
Olive-sided Flycatcher <i>Nuttallornis borealis</i>	Few	Tolerant	17, 18	Stable
Traill's Flycatcher <i>Empidonax traillii</i>	Few	Tolerant	2, 7	Stable
Western Flycatcher <i>E. difficilis</i>	Few	Tolerant	7, 14, 17, 18	Stable
Blue-gray Gnatcatcher <i>Polioptila caerulea</i>	Few	Tolerant	7	Undetermined
Marbled Godwit <i>Limosa fedoa</i>	Few	Intolerant	0, 2	Stable
American Goldfinch <i>Spinus tristis</i>	Moderate	Tolerant	2	Stable
Lesser Goldfinch <i>S. psaltria</i>	Few	Tolerant	7, 14, 17, 18	Undetermined
Eared Grebe <i>Podiceps caspicus</i>	Few	Intolerant	0, 2	Stable
Horned Grebe <i>P. auritus</i>	Few	Intolerant	0, 2	Unknown
Pied-billed Grebe <i>Podilymbus podiceps</i>	Moderate	Tolerant	0, 2	Stable
Red-necked Grebe <i>Podiceps grisegna</i>	Few	Intolerant	0, 2	Stable
Western Grebe <i>Aechmophorus occidentalis</i>	Moderate	Tolerant	0, 2	Unknown
Black-headed Grosbeak <i>Pheucticus melanocephalus</i>	Few	Tolerant	7, 17	Low
Evening Grosbeak <i>Hesperiphona vespertina</i>	Moderate	Tolerant	14, 17, 18	Stable
Pine Grosbeak <i>Pinicola enucleator</i>	Few	Intolerant	14, 17, 18, 19	Stable

California Gull <i>Larus californicus</i>	Moderate	Tolerant	0, 2	Stable
Ring-billed Gull <i>L. delawarensis</i>	Moderate	Tolerant	0, 2	Stable
Cooper's Hawk <i>Accipiter cooperii</i>	Few	Intolerant	14, 17, 18	Stable
Goshawk <i>A. gentilis</i>	Few	Intolerant	2, 4, 6, 7, 9, 14, 17, 18, 19	Stable
Marsh Hawk <i>Circus cyaneus</i>	Few	Intolerant	1a, 2	Stable
Pigeon Hawk <i>Falco columbarius</i>	Very Few	Intolerant	2, 4, 6, 7	Endangered
Red-tailed Hawk <i>Buteo jamaicensis</i>	Moderate	Intolerant	2, 4, 6, 7	Stable
Sharp-shinned Hawk <i>Accipiter striatus</i>	Few	Intolerant	7, 9, 14, 17, 11, 19	Stable
Sparrow Hawk <i>Falco sparverius</i>	Few	Intolerant	2, 4, 6	Stable
Swainson's Hawk <i>Buteo swainsoni</i>	Few	Intolerant	2, 4, 6, 7	Stable
Anthony's Green Heron <i>Butorides virescens</i>	Few	Intolerant	0, 2	Endangered
Black-crowned Night Heron <i>Nycticorax nycticorax</i>	Very Few	Intolerant	0, 2	Stable
Great Blue Heron <i>Ardea herodias</i>	Few	Intolerant	2, 7	Stable
Calliope Hummingbird <i>Stellula calliope</i>	Moderate	Tolerant	2, 4, 6, 7, 9	Stable
Rufous Hummingbird <i>Selasphorus rufus</i>	Moderate	Tolerant	2, 4, 6, 7 9	Stable
Parasitic Jaeger <i>Stercorarius parasiticus</i>	Unusual Visitor	Intolerant	0, 2	Undetermined
Pinon Jay <i>Gymnorhinus cyanocephala</i>	Moderate	Tolerant	14, 18	Stable

Scrub Jay <i>Aphelocoma coerulescens</i>	Very Few	Tolerant	7, 9	Undetermined
Steller's Jay <i>Cyanocitta stelleri</i>	Abundant	Tolerant	14, 17, 18	Stable
Gray-headed Junco <i>Junco caniceps</i>	Few	Tolerant	14, 17, 18	Undetermined
Oregon Junco <i>J. oreganus</i>	Abundant	Tolerant	14, 17, 18	Stable
Slate-coloured Junco <i>J. hyemalis</i>	Abundant	Tolerant	6, 17	Stable
Kildeer <i>Charadrius vociferus</i>	Moderate	Tolerant	1, 1a, 2, 7	Stable
Belted Kingfisher <i>Megaceryle alcyon</i>	Moderate	Tolerant	0, 2, 7	Stable
Golden-crowned Kinglet <i>Regulus satrapa</i>	Moderate	Tolerant	14, 17, 18	Stable
Ruby-crowned Kinglet <i>R. calendula</i>	Moderate	Tolerant	14, 17, 18	Stable
Horned Lark <i>Eremophila alpestris</i>	Moderate	Intolerant	1, 1a, 2, 14	Stable
Arctic Loon <i>Gavia arctica</i>	Few	Intolerant	0, 2	Unknown
Common Loon <i>G. immer</i>	Few	Intolerant	0, 2	Stable
Black-billed Magpie <i>Pica pica</i>	Few	Tolerant	2, 19	Increasing
Purple Martin <i>Progne subis</i>	Few	Tolerant	14, 17	Undetermined
Western Meadowlark <i>Sturnella neglecta</i>	Abundant	Tolerant	1a, 2	Stable
Common Nighthawk <i>Chordeiles minor</i>	Moderate	Tolerant	2, 4, 7	Stable
Lesser Nighthawk <i>C. acutipennis</i>	Few	Tolerant	2	Undetermined
Clarke's Nutcracker <i>Nucifraga columbiana</i>	Moderate	Tolerant	17, 20	Stable

Pygmy Nuthatch <i>Sitta pygmaea</i>	Moderate	Tolerant	14, 17, 18	Stable
Red-breasted Nuthatch <i>S. canadensis</i>	Moderate	Tolerant	14, 17, 18	Stable
White-breasted Nuthatch <i>S. carolinensis</i>	Moderate	Tolerant	14, 17, 18	Stable
Bullock's Oriole <i>Icterus bullockii</i>	Few	Tolerant	2, 7	Stable
Osprey <i>Pandion haliaetus</i>	Few	Intolerant	0, 2	Endangered
Barn Owl <i>Tyto alba</i>	Few	Tolerant	1a, 2	Stable
Great Grey Owl <i>Strix nebulosa</i>	Few	Intolerant	2, 14, 17, 18	Stable
Great Horned Owl <i>Bubo virginianus</i>	Few	Intolerant	4, 7, 9, 14, 17	Stable
Long-eared Owl <i>Asio otus</i>	Few	Intolerant	7, 9	Stable
Pygmy Owl <i>Glaucidium gnoma</i>	Few	Intolerant	9, 17	Stable
Saw-whet Owl <i>Aegolius acadicus</i>	Few	Intolerant	14, 17, 18	Stable
Screech Owl <i>Otus asio</i>	Few	Tolerant	2, 7, 9	Stable
Short-eared Owl <i>Asio flammeus</i>	Few	Intolerant	2	Stable
Spotted Owl <i>Strix occidentalis</i>	Few	Intolerant	14, 17, 18	Stable
White Pelican <i>Pelecanus erythrorhynchos</i>	Few	Intolerant	0, 2	Stable
Western Wood Pewee <i>Contopus sordidulus</i>	Few	Tolerant	7, 9, 17	Stable
Northern Phalarope <i>Lobipes lobatus</i>	Few	Intolerant	0, 2	Undetermined
Wilson's Phalarope <i>Steganopus tricolor</i>	Very Few	Intolerant	0, 2	Undetermined

Black Phoebe <i>Sayornis nigricans</i>	Very Few	Tolerant	7	Undetermined
Say's Phoebe <i>S. saya</i>	Very Few	Tolerant	2, 4	Undetermined
Semipalmated plover <i>Charadrius semipalmatus</i>	Very Few	Intolerant	0, 2	Undetermined
Poor-will <i>Phalaenoptilus nuttallii</i>	Moderate	Tolerant	2, 4, 6	Stable
Virginia Rail <i>Rallus limicola</i>	Few	Tolerant	0, 2	Stable
Common Raven <i>Corvus corax</i>	Moderate	Tolerant	All types	Stable
Robin <i>Turdus migratorius</i>	Abundant	Tolerant	2, 7, 9	Stable
Least Sandpiper <i>Erolia minutilla</i>	Few	Intolerant	0, 2	Stable
Spotted Sandpiper <i>Actitis macularia</i>	Moderate	Intolerant	0, 2	Stable
Western Sandpiper <i>Ereunetes mauri</i>	Few	Intolerant	0, 2	Stable
Williamson's Sapsucker <i>Sphyrapicus thyroideus</i>	Moderate	Tolerant	14, 17, 18, 19	Stable
Yellow-bellied Sapsucker <i>S. varius</i>	Moderate	Tolerant	7, 9	Stable
Loggerhead Shrike <i>Lanius ludovicianus</i>	Very Few			Undetermined
Northern Shrike <i>L. excubitor</i>	Very Few	Tolerant	2	Undetermined
Pine Siskin <i>Spinus pinus</i>	Few	Tolerant	14, 17, 18, 19	Undetermined
Common Snipe <i>Capella gallinago</i>	Few	Intolerant	0, 2	Stable
Townsend's Solitaire <i>Myadestes townsendi</i>	Few	Tolerant	14, 17, 18	Undetermined
Black-throated Sparrow <i>Amphispiza bilineata</i>	Few	Tolerant	2	Undetermined

Brewer's Sparrow <i>Spizella breweri</i>	Moderate	Tolerant	4	Stable
Chipping Sparrow <i>S. passerina</i>	Moderate	Tolerant	17	Stable
Fox Sparrow <i>Paserella iliaca</i>	Moderate	Tolerant	4, 6, 17	Stable
Golden-crowned Sparrow <i>Zonotrichia atricapilla</i>	Moderate	Tolerant	18, 19, 20	Stable
Harris' Sparrow <i>Z. querula</i>	Moderate	Tolerant	17, 18, 19	Stable
House Sparrow (English) <i>Passer domesticus</i>	Abundant	Tolerant	Cities	Stable
Lark Sparrow <i>Chondestes grammacus</i>	Moderate	Tolerant	4, 6	Stable
Lincoln's Sparrow <i>Melospiza lincolni</i>	Moderate	Tolerant	2, 7	Stable
Savannah Sparrow <i>Passerculus sandwichensis</i>	Moderate	Tolerant	2	Stable
Song Sparrow <i>Melospiza melodia</i>	Moderate	Tolerant	2, 7	Stable
Vesper Sparrow <i>Pooecetes gramineus</i>	Few	Tolerant	4	Undetermined
White-crowned Sparrow <i>Zonotrichia leucophrys</i>	Moderate	Tolerant	6	Stable
Starling <i>Sturnus vulgaris</i>	Moderate	Tolerant	2, Cities	Increasing
Bank Swallow <i>Riparia riparia</i>	Moderate	Tolerant	2, 7, 9	Stable
Barn Swallow <i>Hirundo rustica</i>	Moderate	Tolerant	2, 7, 9	Stable
Cliff Swallow <i>Petrochelidon pyrrhonota</i>	Moderate	Tolerant	2, 7, 9	Stable
Rough-winged Swallow <i>Stelgidopteryx ruficollis</i>	Few	Tolerant	2, 7	Stable
Tree Swallow <i>Iridoprocne bicolor</i>	Abundant	Tolerant	2, 7, 14, 17	Stable

Violet Green Swallow <i>Tachycineta thalassina</i>	Moderate	Tolerant	7, 14, 17	Stable
Vaux swift <i>Chaetura vauxi</i>	Moderate	Tolerant	All types	Stable
White-throated Swift <i>Aeronautes sexatalis</i>	Moderate	Tolerant	All types	Stable
Western Tanager <i>Piranga ludoviciana</i>	Few	Tolerant	14, 17, 18	Undetermined
Black Tern <i>Chlidonias niger</i>	Few	Intolerant	0, 2	Stable
Forster's Tern <i>Sterna forsteri</i>	Moderate	Intolerant	0, 2	Stable
Hermit Thrush <i>Hylocichla guttata</i>	Moderate	Tolerant	14, 17, 18	Stable
Swainson's Thrush <i>H. ustulata</i>	Moderate	Tolerant	7, 9	Stable
Varied Thrush <i>Ixoreus naevius</i>	Few	Tolerant	7, 9, 17	Undetermined
Green-tailed Towhee <i>Chlorura chlorura</i>	Few	Tolerant	14	Undetermined
Rufous-sided Towhee <i>Pipilo erythrrophthalmus</i>	Few	Tolerant	4, 6	Undetermined
Solitary Vireo <i>Vireo solitarius</i>	Moderate	Tolerant	7, 9	Stable
Warbling vireo <i>V. gilvus</i>	Moderate	Tolerant	7, 9	Stable
Turkey Vulture <i>Cathartes aura</i>	Moderate	Tolerant	All types	Stable
Audubon's Warbler <i>Dendroica auduboni</i>	Moderate	Tolerant	14, 17, 18	Stable
Black-throated Gray Warbler <i>D. nigrescens</i>	Few	Tolerant	9	Undetermined
Hermit Warbler <i>D. occidentalis</i>	Moderate	Tolerant	14, 17, 18	Stable

MacGillivray's Warbler <i>Oporornis tolmie</i>	Moderate	Tolerant	6, 7	Stable
Myrtle Warbler <i>Dendroica coronata</i>	Few	Tolerant	9, 17	Undetermined
Nashville Warbler <i>Vermivora ruficapilla</i>	Moderate	Tolerant	9	Stable
Orange-crowned Warbler <i>V. celata</i>	Moderate	Tolerant	6, 7, 9	Stable
Townsend's Warbler <i>Dendroica townsendi</i>	Few	Tolerant	14, 17, 18	Undetermined
Yellow Warbler <i>D. petechia</i>	Moderate	Tolerant	7, 9	Stable
Yellow-throated Warbler <i>Geothlypis trichas</i>	Abundant	Intolerant	2	Stable
Wilson's Warbler <i>Wilsonia pusilla</i>	Moderate	Tolerant	7	Stable
Water Pipit <i>Anthus spinolella</i>	Few	Tolerant	2, 20	Undetermined
Cedar Waxwing <i>Bombycilla cedrorum</i>	Few	Tolerant	9	Undetermined
Willet <i>Catoptrophorus semipalmatus</i>	Few	Intolerant	0, 2	Stable
Black-backed, three-toed Woodpecker <i>Picoides arcticus</i>	Moderate	Intolerant	18, 19	Stable
Downy Woodpecker <i>Dendrocopos pubescens</i>	Moderate	Tolerant	7, 9, 14, 17, 18	Stable
Hairy Woodpecker <i>D. villosus</i>	Moderate	Tolerant	7, 9, 14, 17, 18	Stable
Lewis Woodpecker <i>Asyndesmus Lewisi</i>	Moderate	Tolerant	7, 9, 14, 17, 18	Stable
Pileated Woodpecker <i>Dryocopus pileatus</i>	Few	Intolerant	14, 17, 18	Decreasing
White-headed Woodpecker <i>Dendrocopos albolarvatus</i>	Moderate	Tolerant	14, 17, 18	Stable

Bewick's Wren <i>Thryomanes bewickii</i>	Few	Tolerant	6	Undetermined
House Wren <i>Troglodytes aedon</i>	Moderate	Tolerant	9, 4, 6	Stable
Long-billed Marsh Wren <i>Telmatodytes palustris</i>	Moderate	Tolerant		
Rock Wren <i>Salpinctes obsoletus</i>	Moderate	Intolerant	1, 2, 20	Stable
Winter Wren <i>Troglodytes troglodytes</i>	Moderate	Tolerant	14, 17, 18	Stable
Greater Yellowlegs <i>Totanus melanoleucus</i>	Few	Intolerant	0, 2	Stable

This publication is one of a group issued jointly by the Tahoe Regional Planning Agency and the USDA Forest Service. Each publication describes and inventories a natural resource or other characteristic that is significant to the total environment of the Lake Tahoe Region; it attempts to show the hazards incidental to improperly planned development of the area and to provide information helpful in designing controls that must be implemented if the scenic beauty of the Lake Tahoe Region is to be preserved and its other natural resources are to be conserved. These publications are not exhaustive treatises of their subjects, but they highlight the known significant information and data useful in the planning effort underway. Subjects of publications in this series are:

Climate and Air Quality of the Lake Tahoe Region

- ~ *Cultural and Historical Significance of the Lake Tahoe Region*
- ~ *Land Resources of the Lake Tahoe Region*
- ~ *Fisheries of Lake Tahoe and Its Tributary Waters*
- ~ *Geology and Geomorphology of the Lake Tahoe Region*
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